

# 1 The organisation of the human body



In this unit you will find out the answers to these questions:

- What characteristics does a human being need to be considered living?
- What is a **cell**? Is all matter formed by cells?
- Are all the cells in a human being the same?
- What are the **organs** in our body for? Are they all equally important?
- Do our organs function independently, or is the function of each one related to the functions of the others?

Before you start, check you understand the meaning of the words in blue.



## KEY WORDS

**cell:** basic structural and functional unit of the body

**organ:** collection of various tissues in the body that form different units with different functions



## KEY WORDS

**biomolecule:** smallest unit an organism can be divided into

**multicellular:** containing more than one cell

**eukaryote:** organism made of cells that have a nucleus

**heterotrophic:** obtaining nutrition from compounds that already exist

**organelle:** special compartment inside a eukaryotic cell that performs a specific function

## 1 From cells to organisms

Human beings are living things.

- They are composed of chemical substances called **biomolecules**.
- They are made up of cells.
- They perform the three vital functions of all organisms: nutrition, reaction to stimuli and reproduction.

Our body is a **multicellular** organism. It is made up of many cells, which have different structures and functions.

Human beings are animals, because:

- They are **eukaryotes**.
- Their nutrition is **heterotrophic**.

Cell theory is based on the following series of principles:

- A cell is the structural and functional unit in all living things.
- All our cells come from successive divisions of one initial cell, a fertilised egg cell called the zygote.

The cell is the basic structural and functional unit of an organism.

The cells in our body come in very different shapes and sizes, but they all share the same basic structure.

- **Cell membrane.** A fine layer that separates the cell from the outside environment and allows substances to enter and leave.
- **Cytoplasm.** Jelly-like substance inside the cell, which contains many types of organelle and where the majority of the vital chemical functions take place.
- **Nucleus.** A structure containing the genetic material with the necessary information to direct and control the cell's functions.

**Mitochondria.** These have a double membrane and produce energy through cell respiration.

**Vacuoles.** Membrane-bound vesicles that store different substances.

**Lysosomes.** Membrane-bound vesicles that contain digestive enzymes. They carry out the digestion of large molecules or old organelles.

**Cytoskeleton.** Protein filaments that form complex networks. They maintain the shape of the cell and are involved in organelle movement in cell division.



**Ribosomes.** Small organelles with no membrane, made up of RNA and proteins. They are scattered throughout the cytoplasm or are attached to the rough endoplasmic reticulum. They synthesise proteins.

**Endoplasmic reticulum.** A membrane system that forms a network of tubules and bags. There are two types:

- **Rough.** It has ribosomes on the outside of its membranes. It synthesises and stores proteins.
- **Smooth.** It has no ribosomes. It synthesises fats and destroys toxic substances.



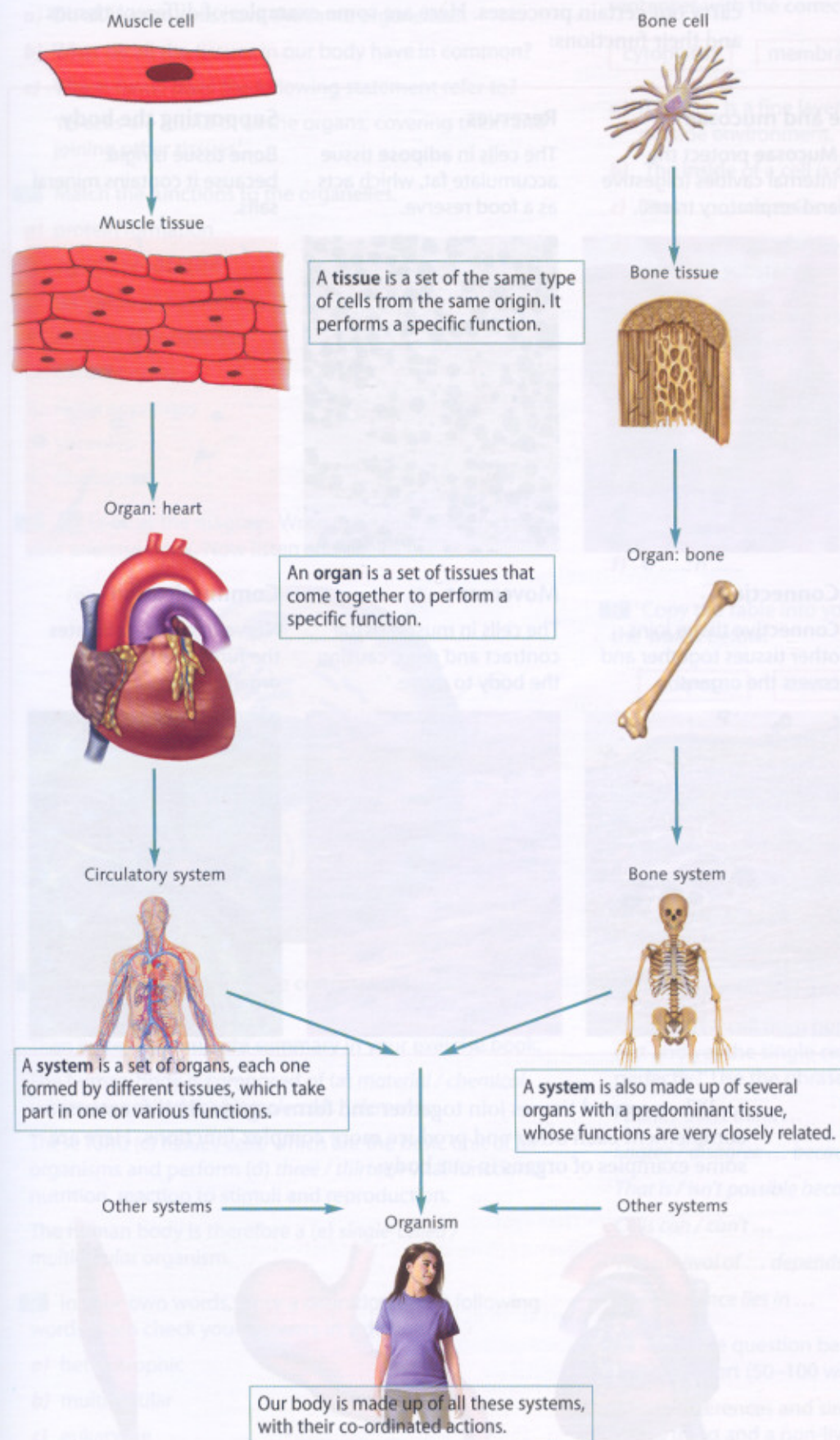
**Golgi apparatus.** A membranous organelle formed by flattened stacked pouches (cisternae). It takes proteins manufactured in the endoplasmic reticulum to where they are used.

**Centrioles.** Cylinders formed by tubules that direct the movement of the cilia and flagella. They are also responsible for delivering genetic material during cell division.





In multicellular organisms, cells are differentiated, specialised and contain different organelles. They are grouped together to form more complex structures. This happens in the following way:



From the cell to the whole organism

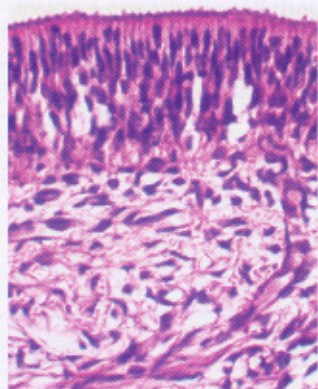


## 2 Tissues and organs

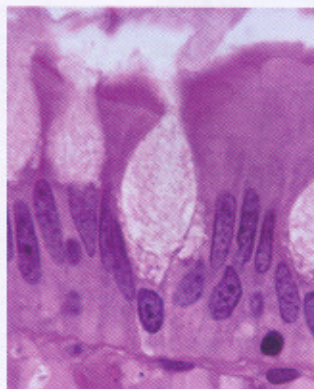
Tissues perform specific functions because their cells are specialised to carry out certain processes. Here are some examples of different tissues and their functions:

### Protection (epithelial tissue and mucosae)

**Epithelial tissue** is the outer covering of the body; the skin.

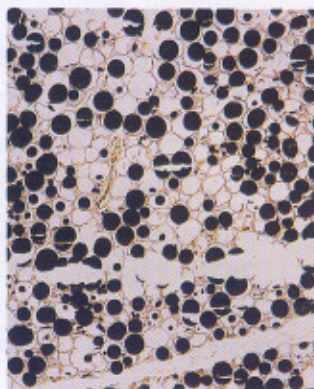


**Mucosae** protect the internal cavities (digestive and respiratory tracts).



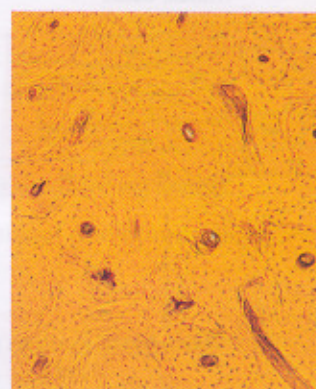
### Reserves

The cells in **adipose tissue** accumulate fat, which acts as a food reserve.



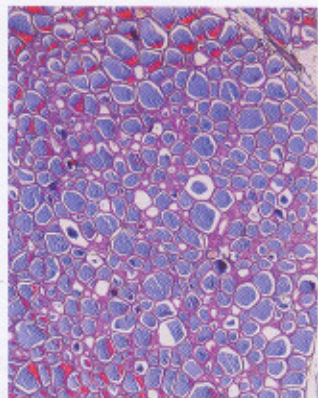
### Supporting the body

**Bone tissue** is rigid because it contains mineral salts.



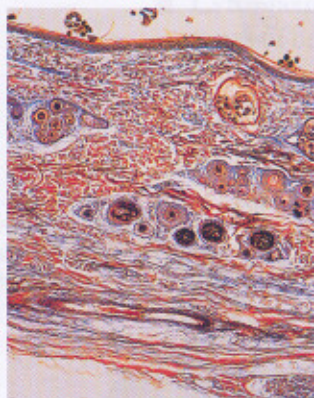
### Secretion

**Gland tissue** produces and releases substances with different functions.



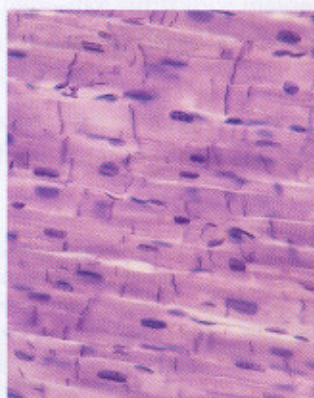
### Connection

**Connective tissue** joins other tissues together and covers the organs.



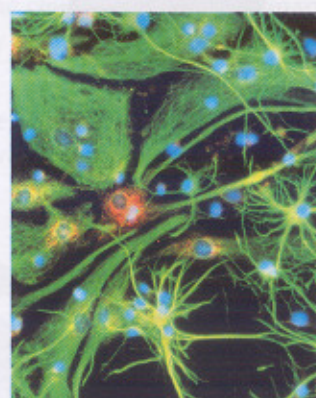
### Movement

The cells in **muscle tissue** contract and relax, causing the body to move.

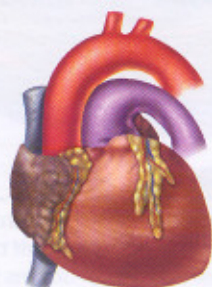


### Communication

**Nerve tissue** co-ordinates the functions of all the organs.



When several tissues join together and form organs, their functions complement each other and produce more complex functions. Here are some examples of organs in our body:



Heart



Stomach



Muscle



## Activities

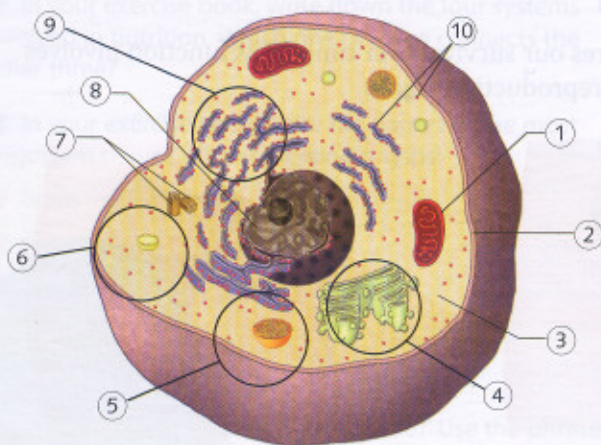
1 Answer the questions.

- Do all human cells have the same organelles?
- What do all the tissues in our body have in common?
- Which tissue does the following statement refer to?  
'Its cells are found in all the organs, covering them and joining other tissues.'

2 Match the functions to the organelles.

- protein formation
  - energy production
  - secretion of substances
  - storage of substances
- mitochondria
  - Golgi apparatus
  - vacuoles
  - ribosomes

3 Look at the diagram. Write the name of each part in your exercise book. Now listen and check.



4 Listen and choose the correct word in the summary.

Then write the complete summary in your exercise book.

The human body is composed of (a) *material / chemical* substances called (b) *biomolecules / elements*.

These form (c) *tissue / cells*, which are the basic unit of all organisms and perform (d) *three / thirteen* vital functions: nutrition, reaction to stimuli and reproduction.

The human body is therefore a (e) *single-celled / multicellular* organism.

5 In your own words, write a definition of the following words. Then check your answers in a dictionary.

- heterotrophic
- multicellular
- eukaryote

6 In your exercise book, copy and complete the sentences with the correct words from the boxes.

cytoplasm

membrane

nucleus

vacuoles

- A \_\_\_\_\_ is a fine layer that separates the cell from the outside environment.
- The inside of a cell is called the \_\_\_\_\_.
- The \_\_\_\_\_ contains all our genetic material.
- \_\_\_\_\_ are membrane-bound vesicles that store different substances.

7 Copy and complete the types of tissue with the missing vowels in your exercise book.

- g l \_ \_ n d
- c \_ n n \_ \_ c t \_ \_ v \_ \_
- n \_ \_ r v \_ \_
- \_ \_ d \_ \_ p \_ \_ s \_ \_
- \_ \_ p \_ \_ t h \_ \_ l \_ \_ \_ l
- b \_ \_ n \_ \_

8 Copy the table into your exercise book, then classify the words below.

adipose

excretory

heart

nerve

respiratory

skin

stomach

Tissue	Organs	Systems

9 In pairs, read and discuss the following question:

'Why can't a cell from our body live separately from the rest and yet the single cell of a protozoan can survive perfectly?' Use the phrases below to help you.

*I think / don't think ...*

*I agree / disagree ... because ...*

*That is / isn't possible because ...*

*Cells can / can't ...*

*The survival of ... depends on ...*

*The difference lies in ...*

10 Read the question below. In your exercise book, write a short report (50–100 words) with your views.

'What differences and similarities are there between a living thing and a non-living thing?'



## KEY WORDS

**oxygen:** colourless and odourless gas essential for most forms of life

**blood:** red fluid that circulates in our veins and arteries

**nutrient:** essential part of our diet, e.g. carbohydrate

**hormone:** chemical released into the bloodstream by a cell or a gland

**bone:** hard, rigid structural material our skeleton is made of

**muscle:** structure made up of bundles of specialised cells that can contract or relax

**health:** absence of physical or mental disease; how well you are in body and mind

## 3 Systems

Systems, made up of organs, are responsible for carrying out the functions of nutrition, reproduction and reaction to stimuli.

### Nutrition

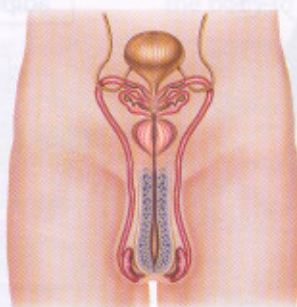
Nutrition is the set of processes that enable us to use and transform the substances we need to stay alive. It involves four systems:

- **Digestive system.** This prepares food so that the cells can use it.
- **Respiratory system.** This supplies **oxygen** to the blood and takes away carbon dioxide. This happens during breathing.
- **Circulatory system.** This uses **blood** to distribute **nutrients** and oxygen among the cells. It also picks up the waste substances produced by cells.
- **Excretory system.** This takes the substances produced by excretion and discharges them outside the body. It also takes part in regulating the internal environment.



### Reproduction

Reproduction assures our survival over time. This function involves both male and female reproductive organs.



### Reaction to stimuli

Several systems and organs are involved in the reaction to stimuli.

- **The sensory organs.** These pick up information and enable the organism to adapt and survive.
- **The nervous system.** This receives information from outside and works out suitable responses. It co-ordinates and unites all the bodily functions.
- **The endocrine system.** This is made up of certain organs that secrete substances (**hormones**) that have different effects on our body.
- **The skeletal system and the muscular system.** These are responsible for a person's movement. They are formed by **bones** and **muscles**, respectively.

For our body to function properly, all these systems must work together in a co-ordinated way. This allows cells to perform the necessary functions correctly to keep us in good **health**.



The skeletal system and the muscular system



## Activities

- 11** In your exercise book, write one sentence that contains and links the words below.

cells

tissues

organs

Golgi apparatus

systems

- 12** In your exercise book, write the name of an organ that has:

- a) nerve tissue
- b) connective tissue

- 13** True (T) or false (F)? Read the sentences and write the answers in your exercise book. Correct the false sentences.

- a) Our lungs are involved in nutrition.
- b) Men and women have reproductive organs.
- c) Tissues are made up of organs.
- d) Oxygen is not involved in the circulatory system.
- e) The endocrine system is responsible for the body's movement.

- 14** In your exercise book, write down the four systems involved in nutrition. Which one of these connects the other three?

- 15** In your exercise book, write the names of the most important tissues in the following organs:

- a) bone
- b) skin
- c) gland
- d) heart

- 16** In pairs, discuss the following question:

'Can blood be considered to be a tissue?' Use the phrases below to help you.

*I think / don't think ... because ...*

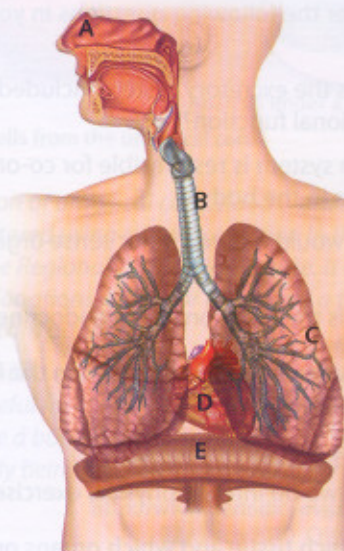
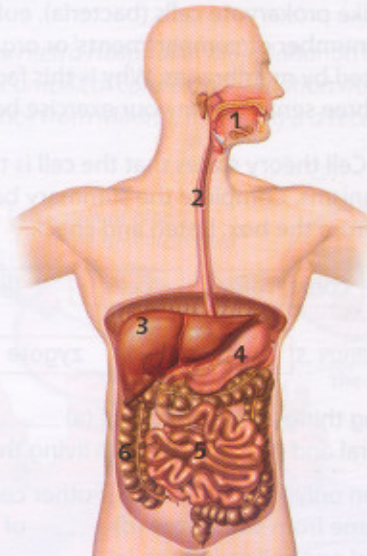
*I agree / disagree because ...*

*That can / can't be possible because ...*

- 17** Work in pairs. Time yourselves and try to write down the functions of the following systems in your exercise books in one minute. Then check each other's work and discuss any mistakes.

- Digestive system
- Respiratory system
- Circulatory system
- Excretory system
- Nervous system
- Endocrine system
- Skeletal system and muscular system

- 18** Look at the diagrams. In your exercise book, answer the questions below.



- a) What systems are shown in the diagrams?
- b) Write the names of parts 1 to 5 and A to E.

- 19** Read the following questions: 'Why do people say that sense organs enable an organism to adapt and survive? Why is the reaction to stimuli function important in this process?'

In your exercise book, write a short text (80–100 words) to answer them and give reasons for your answer. Use the words in the boxes to help you.

environment

danger

feel

hear

important

outside

smell

taste


touch



# Revision activities

**1** What are the main differences between animals and plants? Write them in your exercise book.

**2** Unlike prokaryote cells (bacteria), eukaryote cells have a number of 'compartments' or organelles separated by membranes. Why is this fact important? Write three sentences in your exercise book.

**3**  Cell theory states that the cell is the life unit in all organisms. Complete the summary below with the words from the box. Listen and check.

come from

cells

divisions

functional

zygote

All living things are made up of (a) \_\_\_\_\_. A cell is the structural and (b) \_\_\_\_\_ unit in living things.


Cells can only (c) \_\_\_\_\_ other cells. All human cells come from successive (d) \_\_\_\_\_ of a single, fertilised egg cell called the (e) \_\_\_\_\_.

**4** Answer the following questions in your exercise book.

- a)** Why is the excretory system included in our body's nutritional function?
- b)** Which system is responsible for co-ordinating all the organs in the body?
- c)** What would happen if our sense organs did not exist?
- d)** What is the function of the endocrine system?

**5** Which systems are stimulated in the following situations?

- a)** When we are given a fright.
- b)** When we do intense physical exercise.

**6**  Which tissue and which organs or systems correspond to the following functions? Write the answers in your exercise book. Then listen and check.

- a)** Protecting and covering the body.
- b)** Co-ordinating and regulating our functions.
- c)** The protection of internal cavities.
- d)** Hormone production.
- e)** Supporting the body.

**7** Copy and complete the sentences in your exercise book. Use the verbs from the boxes in the present simple affirmative.

contain

deliver

destroy

produce

store

synthesise

**a)** Mitochondria \_\_\_\_\_ energy through cell respiration.

**b)** Lysosomes \_\_\_\_\_ digestive enzymes.

**c)** Smooth endoplasmic reticulum \_\_\_\_\_ toxic substances.

**d)** Ribosomes \_\_\_\_\_ proteins.

**e)** Centrioles \_\_\_\_\_ genetic material through cell division.

**f)** Rough endoplasmic reticulum \_\_\_\_\_ proteins.

**8** Match the systems to their functions.

- |   |                            |
|---|----------------------------|
| <b>a)</b> Digestive system                                | <b>d)</b> Excretory system |
| <b>b)</b> Respiratory system                              | <b>e)</b> Nervous system   |
| <b>c)</b> Circulatory system                              | <b>f)</b> Endocrine system |
| <b>1.</b> transports oxygen                               |                            |
| <b>2.</b> discharges waste substances from out body       |                            |
| <b>3.</b> coordinates and unites all our bodily functions |                            |
| <b>4.</b> prepares food for cells to use                  |                            |
| <b>5.</b> secretes hormones                               |                            |
| <b>6.</b> distributes nutrients and oxygen among cells    |                            |

## Talking points

**9** In pairs, discuss the following question: 'Why do you think that the majority of cells are spherical in shape?' Use the phrases below to help you. Give reasons for your answer.

*I think cells are spherical because ...*

*If they were not spherical ...*

*Some cells are not spherical because ...*

*Cells have to ... so it is ...*

**10** In pairs, discuss the following question: 'Why do you think that some living people can donate a kidney or part of their liver?' Use the phrases below to help you.

*I think they can do this because ...*

*The liver is ... so it can ...*

*This can be necessary when someone ...*

*This allows the person to ...*

*I think / don't think this is a good idea because ...*

**11** Read the statement below.

'In certain tissues in an adult there are cells that are still able to divide and differentiate themselves indefinitely. They are stem cells. Why are these cells important for science and for our health?'

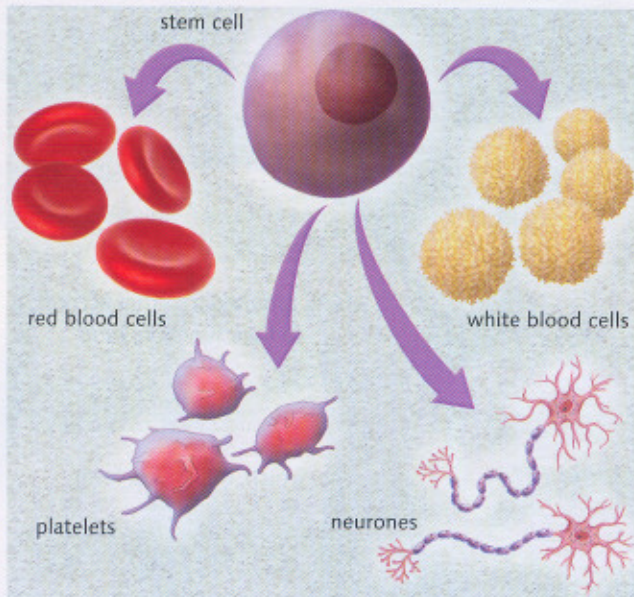
Research the topic of stem cells and write a short text (80–100 words) on your findings.



# Revision activities

## Development of basic competences

Stem cells are defined as self-renewable parent cells capable of regenerating one or more different cell types.



In higher mammals, stem cells are classified into two groups:

- **Embryonic stem cells.** These come from the inner cell mass of the blastocyst-stage embryo (7–14 days) and are capable of generating all the different types of cells in our body; they are therefore called pluripotent cells.
- **Organ-specific stem cells.** They are called multipotent cells and are capable of producing cells from a specific organ in an embryo and in an adult. The best example of this type of stem cell is found in bone marrow. They are capable of producing all types of blood cells and cells involved in the immune system.

The use of stem cell transfer techniques in adults for replacing and repairing sick tissues is still in its early stages.

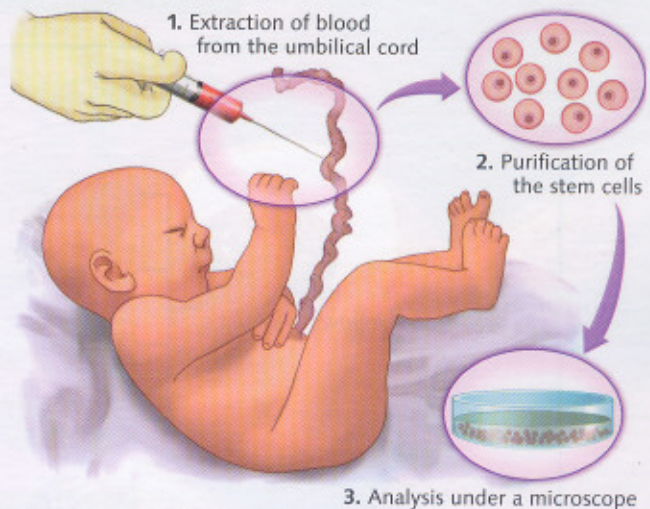
**1** Name the three characteristics all stem cells have.

**2** In single-celled organisms, the single cell is responsible for carrying out all life functions: nutrition, reaction to stimuli and reproduction.

Multicellular organisms are formed by cells that specialise in doing a particular job, organised into tissues and organs, etc.

What are the main advantages and disadvantages of cell specialisation in the case of multicellular organisms?

The Puerta de Hierro Hospital in Majadahonda has collected the first umbilical cord blood donation from a 37-year old donor from Madrid, following a recent birth.



Extracting stem cells from the umbilical cord

Each donation of umbilical cord blood is analysed, processed and stored using cryopreservation in the Madrid Cord Bank, in the Regional Transfusion Centre. It currently has over 5 500 donations. Last year it received a total of 1 648 umbilical cord donations.

Current scientific evidence shows that umbilical cord blood can be useful for treating blood or genetic diseases that may require a bone marrow transplant. Other possible uses are currently being studied.

<http://www.periodicomajadahonda.es/>  
22 March 2010. Cristina de Simón

**3** Which type of stem cells are found in umbilical cord blood?

**4** What does cryopreservation involve?

**5** Name four types of specialised cell that can be formed from umbilical cord stem cells.

**6** Can new tissues be formed from umbilical cord stem cells?

**7** The text mentions bone marrow, but there is also another kind of marrow in the spinal cord.

Research the topic of marrow and find out about the differences between the two types.

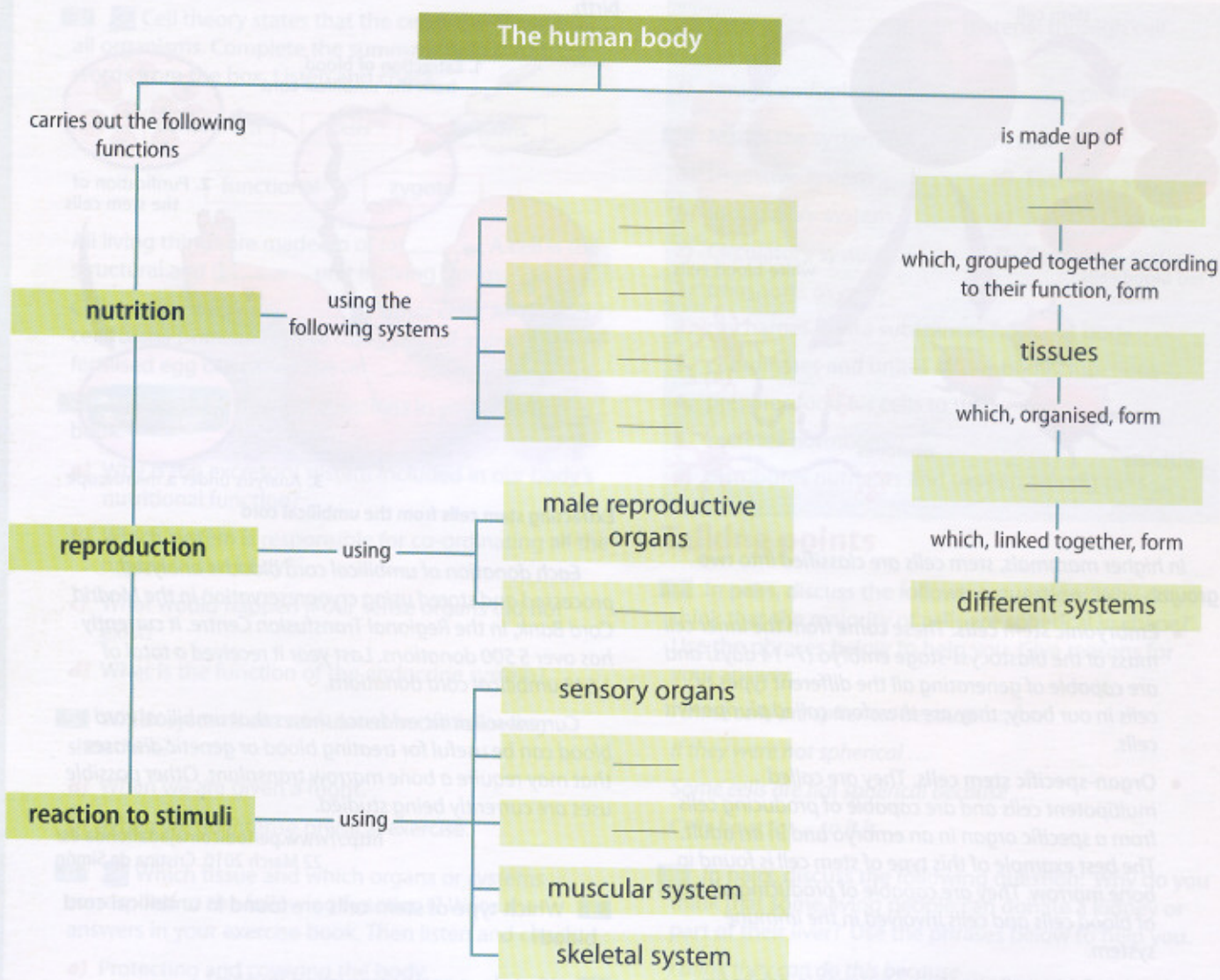
Which of the two is used to cure leukemia and other kinds of blood disease?



# Unit summary

## The organisation of the human body

In your exercise book, copy and complete the chart with the words below.



- |               |                              |                  |
|---------------|------------------------------|------------------|
| ■ cells       | ■ endocrine system           | ■ organs         |
| ■ circulatory | ■ excretory                  | ■ nervous system |
| ■ digestive   | ■ female reproductive organs | ■ respiratory    |